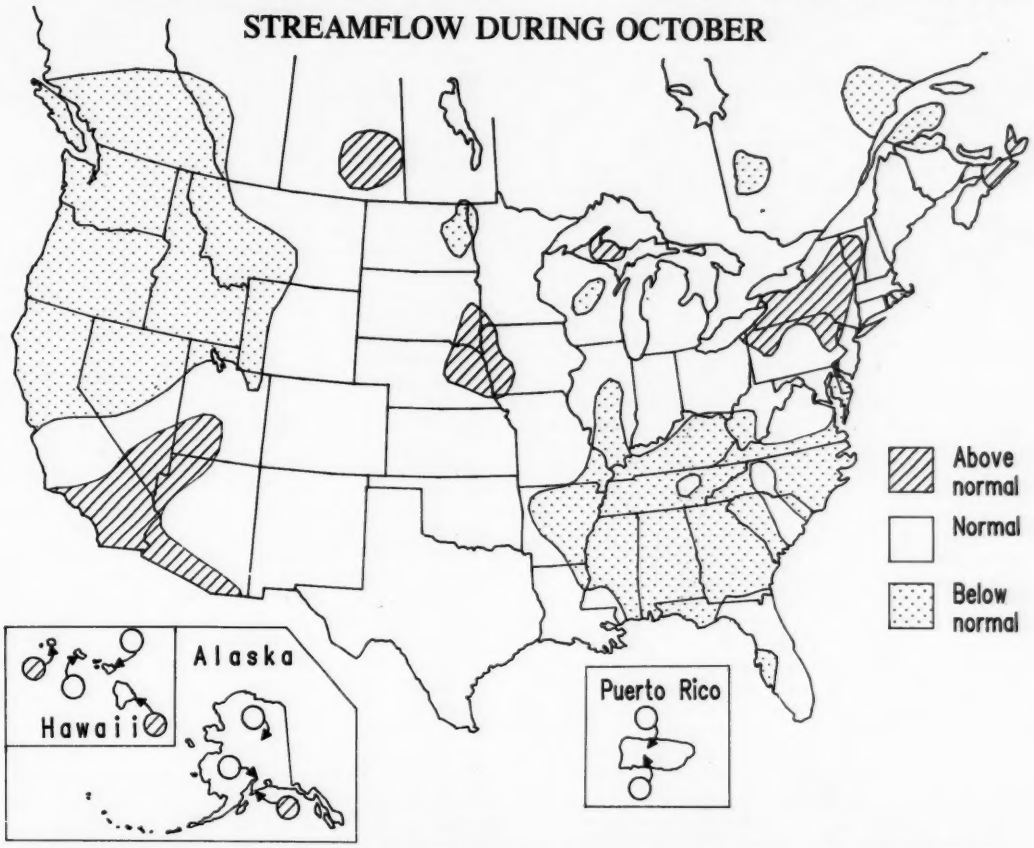
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

OCTOBER 1987

STREAMFLOW DURING OCTOBER



Streamflow in Montana, Idaho, Washington, and Oregon was near, or at, record lows for October at many stations as drought conditions persisted in those States during what is normally the wet time of year. New October minimums occurred at 12 index stations, 8 of which were in those four States.

In sharp contrast, rains from storm cells generated as Hurricane Floyd crossed southern Florida at midmonth increased mean daily flows of two streams by over 600 percent in no more than 5 days. Streamflow in parts of California, Arizona, Utah, and Nevada increased into the above-normal range during the month.

Streamflow was in the normal to above-normal range at 66.3 percent of the 190 reporting index stations in southern Canada, the United States, and Puerto Rico, compared with the 72.2 percent in those ranges for last month. Total October flow of 1,027,440 cubic feet per second was 13.6 percent below median, 17.8 percent below last month's total, and the lowest for October in the last 5 years.

Mean October elevations for the Great Lakes (provisional National Ocean Service data) declined from last month at the master gages on all four lakes and were also significantly below October 1986 levels.

The level of Utah's Great Salt Lake fell 0.15 foot during October, reaching 4,209.45 feet above National Geodetic Vertical Datum (NGVD) of 1929 on October 31. Lake level has fallen 2.40 feet since the March 30, 1987, seasonal high of 4,211.85 feet above NGVD of 1929.

Contents of 76 percent of reporting reservoirs were near or above average for the end of October, compared with 78 percent for the end of September.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged a below-normal 551,400 cfs (about 14 percent below median) during October after decreasing about 11 percent from September to October.

Short-term soil (crop) moisture changes were generally favorable during the month with the exception of three large areas that remained abnormally to excessively dry and a large area from northern Virginia to southern Maine which was wet. The Palmer drought-severity index (long-term) changed little from September to October despite the favorable short-term changes during October.

SURFACE-WATER CONDITIONS DURING OCTOBER 1987

Streamflow in Montana, Idaho, Washington, and Oregon was near, or at, record lows for October at many stations as drought conditions persisted in those States during what is normally the wet time of year. Daily flows at five streamflow stations in Washington and Idaho, including the index station Skykomish River near Goldbar, Washington, representative of various areas were as follows: Kettle River near Laurier (drainage area approximately 3,800 square miles), Washington, flowing from Canada, had record daily lows for 28 of 31 days; Boise River near Twin Springs (drainage area approximately 830 square miles), Idaho, representative of the Middle Snake River basin, had record low flows for 22 of 31 days during the month; both the Sauk River above Whitechuck River near Darrington (drainage area 152 square miles), Washington, representative of flows in the northern Cascades, and the Skykomish River River near Goldbar (see new minimums table on page 4), Washington, representative of flows in the central Cascades, had record low flows for all 31 days; Cispus River near Randle, Washington (drainage area 321 square miles), representative of flows in the southern Cascades, had record low flows for the first 16 days of October.

In sharp contrast, rains from storm cells generated as Hurricane Floyd crossed southern Florida at midmonth increased mean daily flows of Fisheating Creek at Palmdale by 6340 percent and mean daily flows of Peace River near Arcadia, where flow had been at a record daily October low of 77.0 cubic feet per second (cfs) on October 11, by 666 percent. The flow increases on both streams took place within 5 days. Streamflow in parts of California, Arizona, Utah, and Nevada increased into the above-normal range after the remnants of Hurricane Ramon brought scattered rain to the Southwest at midmonth, and thunderstorms and rainshowers moved through the area near monthend. Drought Severity Maps (long-term, Palmer) show a worsening of conditions in southern Florida and little change in the western four-state area despite these rains. On an even wetter note, an October record-breaking 47.75 inches of precipitation (27.63 inches or 137 percent above normal) fell at Yakutat, in southeastern Alaska, bringing total September-October precipitation to over 80 inches.

Flows generally decreased from September to October in about half of the Provinces and States for which data are reported: seasonally in Alaska, Alberta, Colorado, New Mexico, Kansas, South Dakota, Iowa, Illinois, Louisiana, Alabama, and Kentucky; contraseasonally in Washington, Nevada, Oklahoma, Georgia, South Carolina, Virginia, West Virginia, Pennsylvania, New Jersey, and Rhode Island; and variably in British Columbia, Oregon, Montana, North Dakota, Minnesota, Missouri, Texas, Mississippi, and North Carolina. Changes in flow were generally variable in Hawaii, Utah, Arizona, Nebraska, Wisconsin, Arkansas, Tennessee, Ohio, New York, and Florida. Streamflow generally changed seasonally in California, Indiana, Maryland, and Delaware, and increased contrseasonally in Saskatchewan. Flow generally increased seasonally in Puerto Rico and also in the rest of southern Canada and the United States.

Streamflow was in the normal to above-normal range at 66.3 percent of the 190 reporting index stations in southern Canada, the United States, and Puerto Rico, compared with the 72.2 percent in those ranges for last month. This is the lowest percentage of stations with flow in the normal to above-normal range for October in the last five years. Total October flow of 1,027,440 cfs was 13.6 percent below median, 17.8 percent below last month's total, and the lowest for October in the last 5 years: about 247,000 cfs or 19.4 percent below that of October 1983, the second lowest October during the period. Streamflow during October 1987 was 60.8 percent (about 1,597,000 cfs) below that for October 1986, which totalled 2,624,010 cfs (121 percent above median).

New October minimums occurred at 12 index stations (see table on page 4), 3 of them at sites that also recorded new minimums during September: Spokane River at Spokane, Washington; Clearwater River at Spalding, Idaho; and Columbia River at The Dalles, Oregon. Monthly mean flow of the Columbia River at The Dalles, Oregon (drainage area 237,000 square miles), was 48,500 cfs (53 percent of median), the lowest of record for the third consecutive month (see hydrograph on page 10). Flow at this site was 11,110 cfs less than the previous October minimum, which occurred in 1969. Hydrographs of streamflow at eight of the other index stations that recorded new minimums, seven of them located in Oregon, Washington, Idaho, and Montana, are on page 5.

Mean October elevations for the Great Lakes (provisional National Ocean Service data) declined from last month at the master gages on all four lakes: on Lake Superior by 0.21 foot, which was in the normal range for the seventh consecutive month; on Lake Huron by 0.34 foot, which was in the normal range for the third consecutive month (after 41 consecutive months in the above-normal range from March 1984 through July 1987); on Lake Erie by 0.53 foot, which was in the above-normal range for the 41st consecutive month (since June 1984); and on Lake Ontario by 0.29 foot, which was in the below-normal range for the second consecutive month following 4 months in the normal range. Levels ranged from 1.09 feet (Lake Superior) to 2.28 feet (Lake Huron) lower than those for October 1986. Stage hydrographs at the master gages for Lakes Superior, Huron, Erie, and Ontario are on page 6.

The level of Utah's Great Salt Lake fell 0.15 foot during October, reaching 4,209.45 feet above National Geodetic Vertical Datum (NGVD) of 1929 on October 31. Lake level has fallen 2.40 feet since the March 30, 1987, seasonal high of 4,211.85 feet above NGVD of 1929 (see graph on page 6), which equaled the record high set July 3-8, 1986. (The preceding sentences in the September issue should have read as follows, corrections underlined: The level of Utah's Great Salt Lake fell 0.50 foot during September, reaching 4,209.60 feet above NGVD of 1929 on September 30. Lake level has fallen 2.25 feet since the March 30, 1987, seasonal high of 4,211.85 feet above NGVD of 1929, which equaled the record high set July 3-8, 1986.) The level of the lake is 1.50 feet lower than a year ago, but 5.25 feet higher than it was on October 31, 1983.

(Continued on page 4.)

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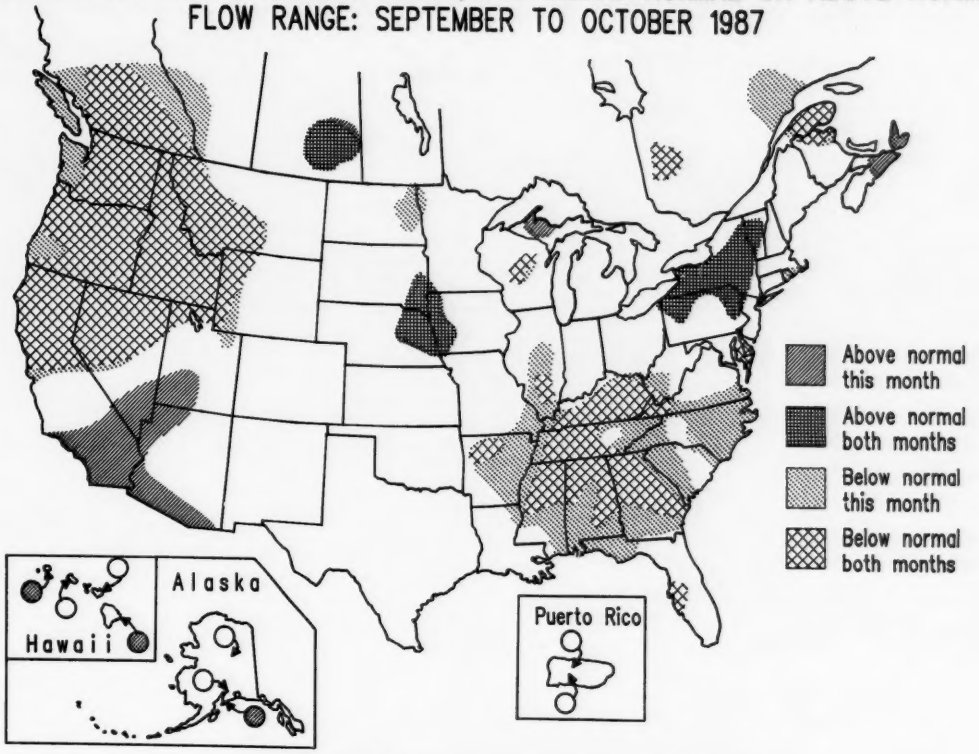
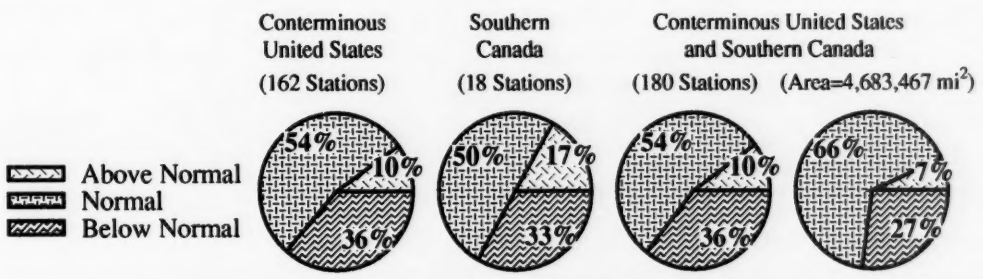
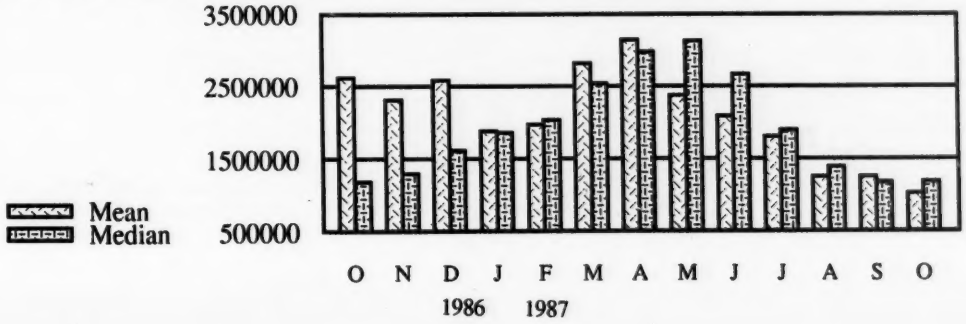
PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW-NORMAL OR ABOVE-NORMAL FLOW RANGE: SEPTEMBER TO OCTOBER 1987



SUMMARY OF OCTOBER 1987 STREAMFLOW
FLOW RANGES



COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS (Cubic Feet per Second)



NEW MINIMUMS DURING OCTOBER 1987 AT STREAMFLOW INDEX STATIONS

Station number	Stream and place of determination	Drainage area (square miles)	Years of record	Previous October minimums (period of record) Monthly mean in cfs (year)	Previous October minimums (period of record) Daily mean in cfs (year)	October 1987 Monthly mean in cfs	October 1987 Percent of median	October 1987 Daily mean in cfs	October 1987 Day
01309500	Massapequa Creek at Massapequa, N.Y.	38	51	2.37 (1965)	1.69 (1965)	2.18	27	1.60	31
02371500	Conecuh River at Brantley, Ala.	492	50	28.6 (1968)	24.0 (1968)	25.7	19	22.0	22
02467000	Tombigbee River at Demopolis Lock & Dam near Coatopa, Ala.	15,400	59	804 (1955)	382 (1931)	795	20	--	--
03308500	Green River at Munfordville, Ky.	1,673	61	69.7 (1953)	56.0 (1919)	42.0	12	--	--
06191500	Yellowstone River at Corwin Springs, Mont.	2,623	81	934 (1931)	800 (1958)	875	59	768	30
12134500	Skykomish River near Gold Bar, Wash.	535	59	488 (1952)	388 (1938)	379	14	356	29
12422500	Spokane River at Spokane, Wash.	4,290	96	955 (1966)	-- --	848	53	840	25
13317000	Salmon River at Whitebird, Idaho	13,550	75	2,952 (1931)	2,620 (1935)	2,880	58	2,570	6
13342500	Clearwater River (Adjusted) at Spalding, Idaho	9,570	65	1,893 (1952)	-- --	1,780	47	1,770	14
14105700	Columbia River (Adjusted) at The Dalles, Oreg.	237,000	109	59,610 (1929)	-- --	48,500	53	--	--
14191000	Willamette River (Adjusted) at Salem, Oreg.	7,280	71	3,020 (1944)	-- --	2,490	37	--	--
14301500	Wilson River near Tillamook, Oreg.	161	57	57.9 (1952)	45.0 (1952)	44.0	7	43.0	11

October precipitation (provisional National Weather Service data) was generally an inch or more below normal in Puerto Rico, most of the area east of a line from Minnesota to Texas, coastal areas in the West from northern California to Canada, part of western Washington and adjacent Idaho, and also in parts of Hawaii. Precipitation was generally an inch or more above average only at scattered sites in Alaska, Hawaii, California, Arizona, Utah, Louisiana, Florida, Michigan, Ohio, Pennsylvania, and New Hampshire. No record-high precipitation totals occurred during October and precipitation exceeded 6 inches at only four cities (in the index site network): Juneau and Kodiak, Alaska; Hilo, Hawaii; and Key West, Florida. No precipitation fell at Tallahassee, Florida, Boise and Lewiston, Idaho, and also at Medford and Pendleton, Oregon, establishing record lows at those sites. Record low totals (amounts in inches) fell at: Cape Hatteras (1.19), North Carolina; Louisville (0.39), Kentucky; Billings (0.01) and Havre (0.03), Montana; Quillayute (1.37), Seattle-Tacoma (0.31), and Spokane (0.03), Washington; and Astoria (0.52) and Portland (0.26), Oregon. Precipitation at Victoria (0.34), Texas, equaled the record low. Total Precipitation and Percentage of Normal Precipitation maps are on page 7.

Crop-moisture (short-term) maps for October 10, 17, 24, and 31 (pages 8-9) show changes to generally favorable conditions during the month with the exception of three large areas that remained abnormally to excessively dry--the Pacific Northwest, southern Texas and small parts of adjacent States, and also southern Alabama and parts of adjacent States--and a large area from northern Virginia to southern Maine which was wet. The Drought-severity (long-term, Palmer) maps for October 17 and 31 (page 10) are very similar to each other and also to the two maps published in last month's issue (page 15)--generally moist in much of the midcontinent and scattered areas adjacent to the Great Lakes; moderate to extreme drought in most of the West; parts of Minnesota and adjacent States; and also much of the East (south of the Great Lakes). An article discussing effects of drought in the Pacific Northwest (page 11) excerpted from the *Weekly Weather and Crop Bulletin* contains illustrations showing percentage of normal precipitation in that area for July 1-October 22, 1987, and cumulative precipitation at Portland, Oregon, for January 1-October 22, 1987. November 1987 through January 1988 outlook maps for both temperature and precipitation are on page 19.

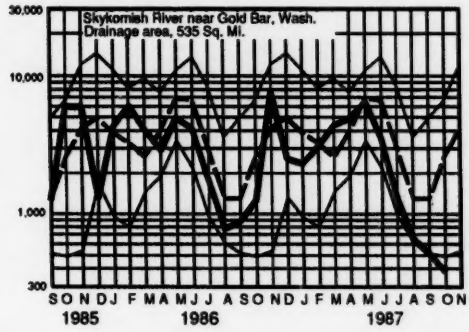
The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--averaged a below-normal 551,400 cfs (about 14 percent below median) during October after decreasing about 11 percent from September to October. This month's combined flow was about 10 percent lower than that of October 1983, the second lowest combined flow for October during the period 1983-87, and about 60 percent lower than the record-high October 1986 combined flow (1,351,500 cfs). Mean flow of the St. Lawrence River at Cornwall, Ontario, was unchanged from that for September and moved into the above-normal range after being in the normal range last month (ending 31 consecutive months in the above-normal range). Mean flow of the Mississippi River at Vicksburg, Mississippi, decreased by about 3 percent from that for September, and moved into the below-normal range after 1 month in the normal range. Mean flow of the Columbia River at The Dalles, Oregon, set a record low for the third consecutive month after decreasing by about 26 percent from that for September, and was in the below-normal range for the fifth consecutive month. Flow hydrographs for both the combined and individual flows of the "Big 3" are shown on page 12. Dissolved solids and water temperatures at five large river stations are given on page 12. October flows of the "Big 3" and other large rivers are given in the Flow of Large Rivers table on page 13.

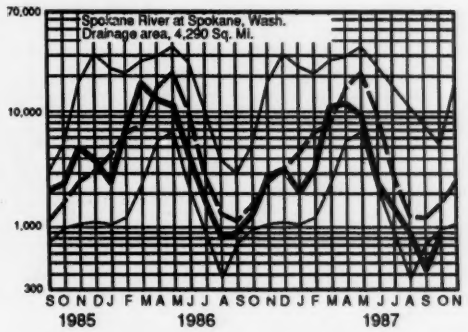
(Continued on page 18)

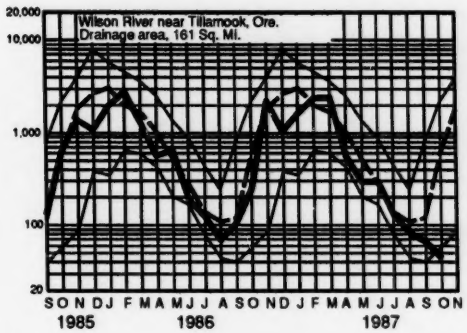
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

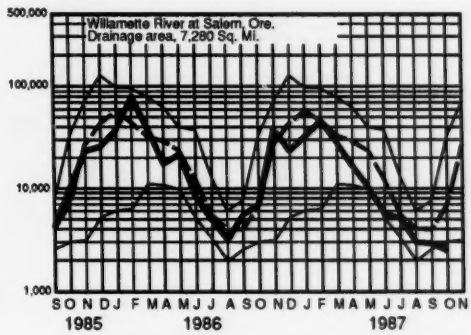
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.

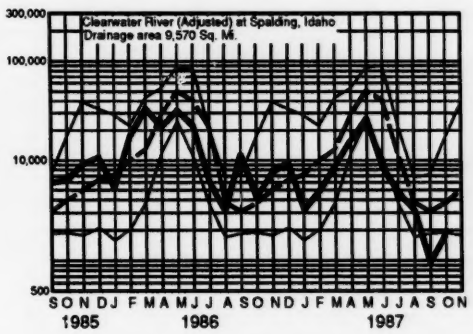
DISCHARGE, IN CUBIC FEET PER SECOND

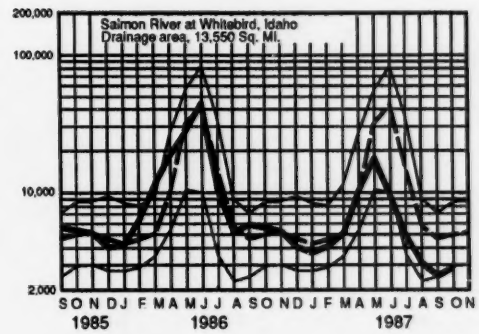

Skykomish River near Gold Bar, Wash.
Drainage area, 535 Sq. Mi.
30,000
10,000
1,000
300
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987

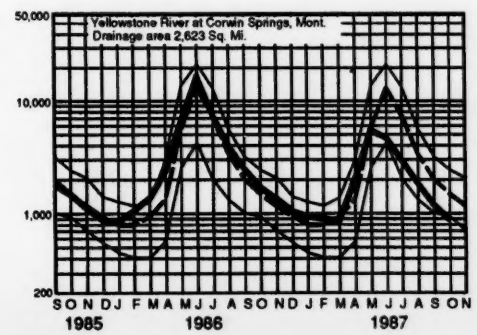

Spokane River at Spokane, Wash.
Drainage area, 4,290 Sq. Mi.
70,000
10,000
1,000
300
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987

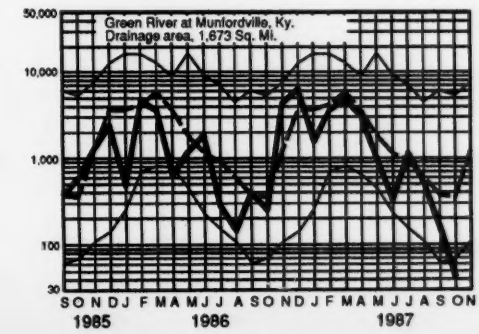

Wilson River near Tillamook, Ore.
Drainage area, 161 Sq. Mi.
20,000
10,000
1,000
100
20
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987


Willamette River at Salem, Ore.
Drainage area, 7,280 Sq. Mi.
500,000
100,000
10,000
1,000
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987


Clearwater River (Adjusted) at Spalding, Idaho
Drainage area 9,570 Sq. Mi.
300,000
100,000
10,000
500
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987

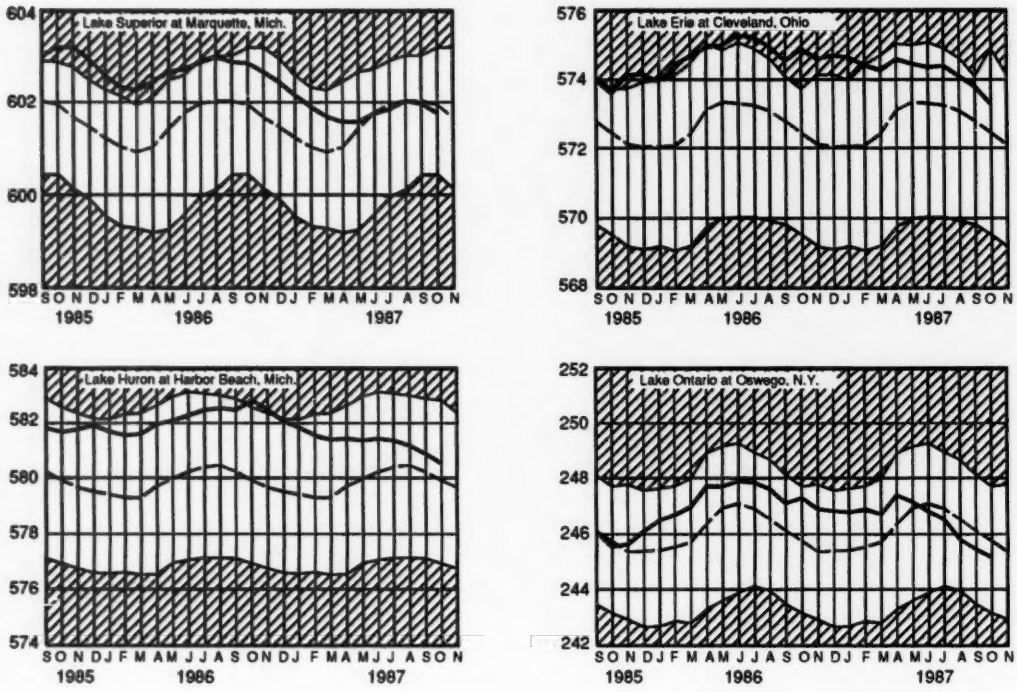

Salmon River at Whitebird, Idaho
Drainage area, 13,550 Sq. Mi.
200,000
100,000
10,000
2,000
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987


Yellowstone River at Corwin Springs, Mont.
Drainage area 2,623 Sq. Mi.
50,000
10,000
1,000
200
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987


Green River at Munfordville, Ky.
Drainage area, 1,673 Sq. Mi.
50,000
10,000
1,000
100
30
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1985
1986
1987

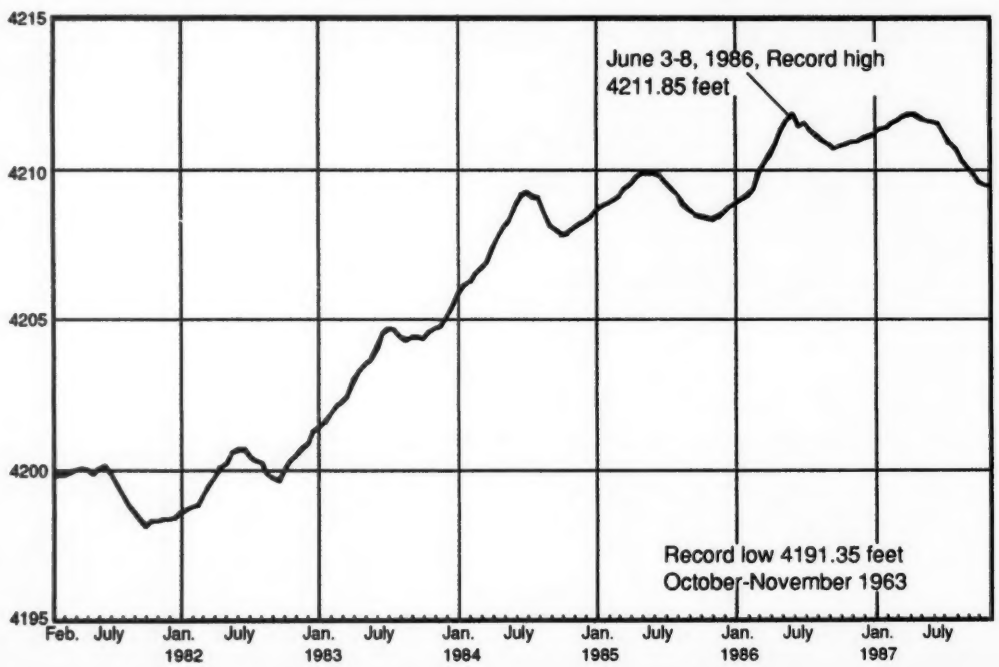
GREAT LAKES ELEVATIONS

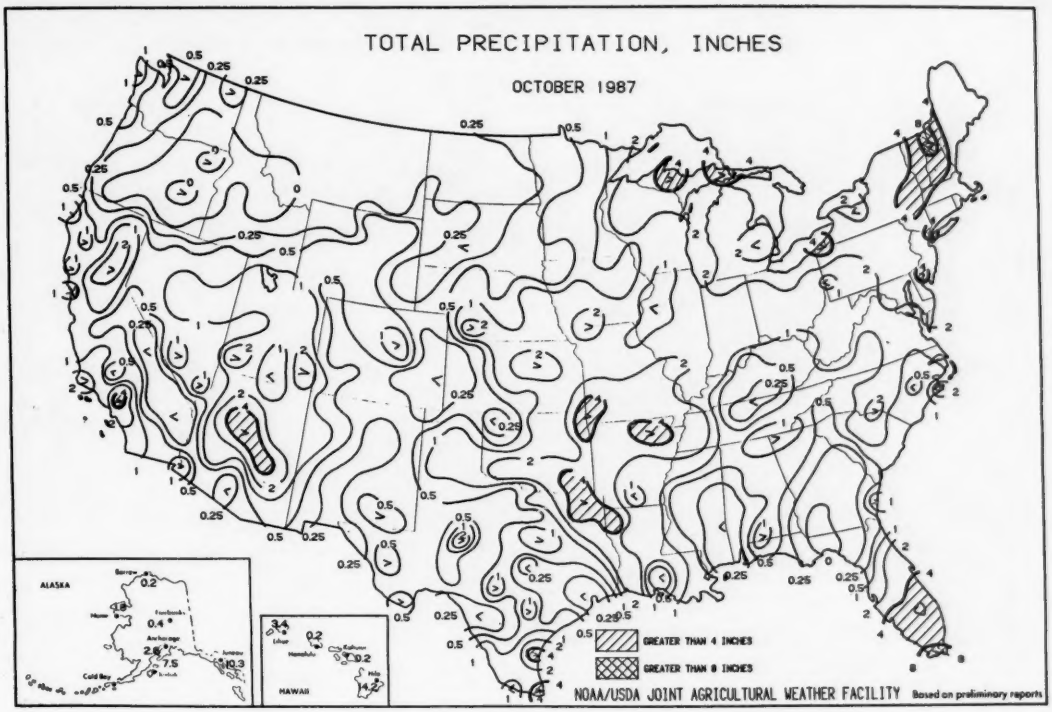
Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

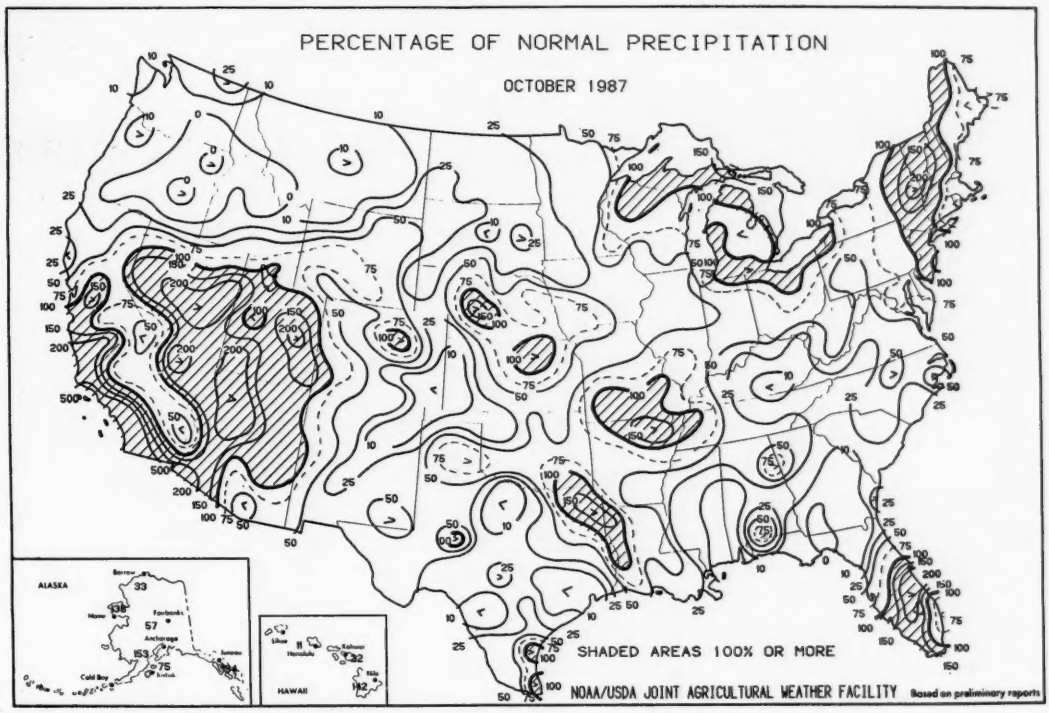


ELEVATION, IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929

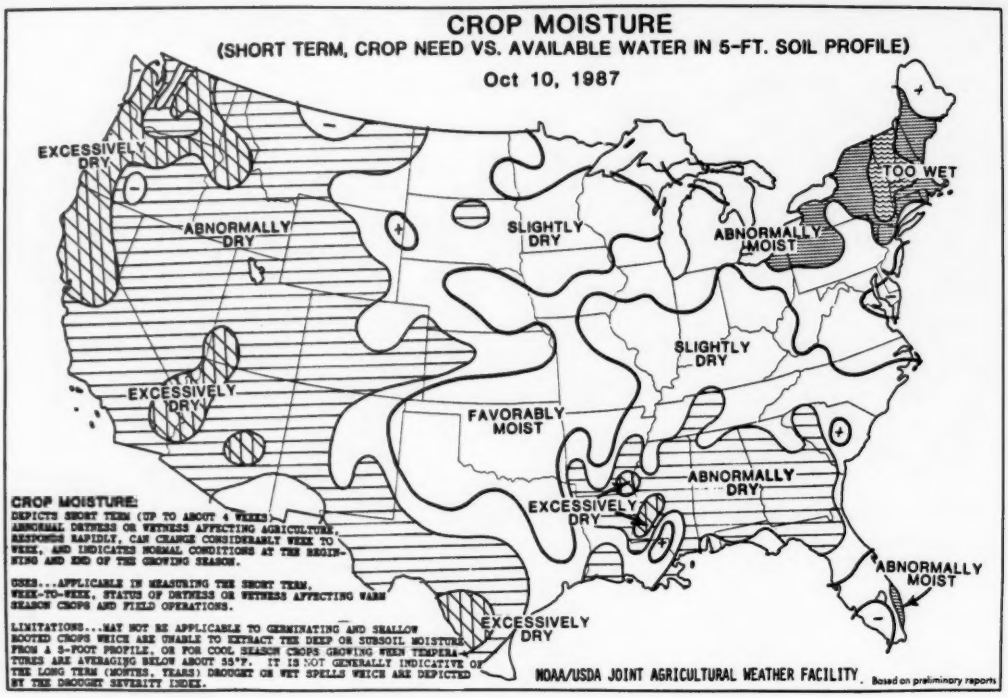
Fluctuations of Great Salt Lake, February 1981 through October 1987

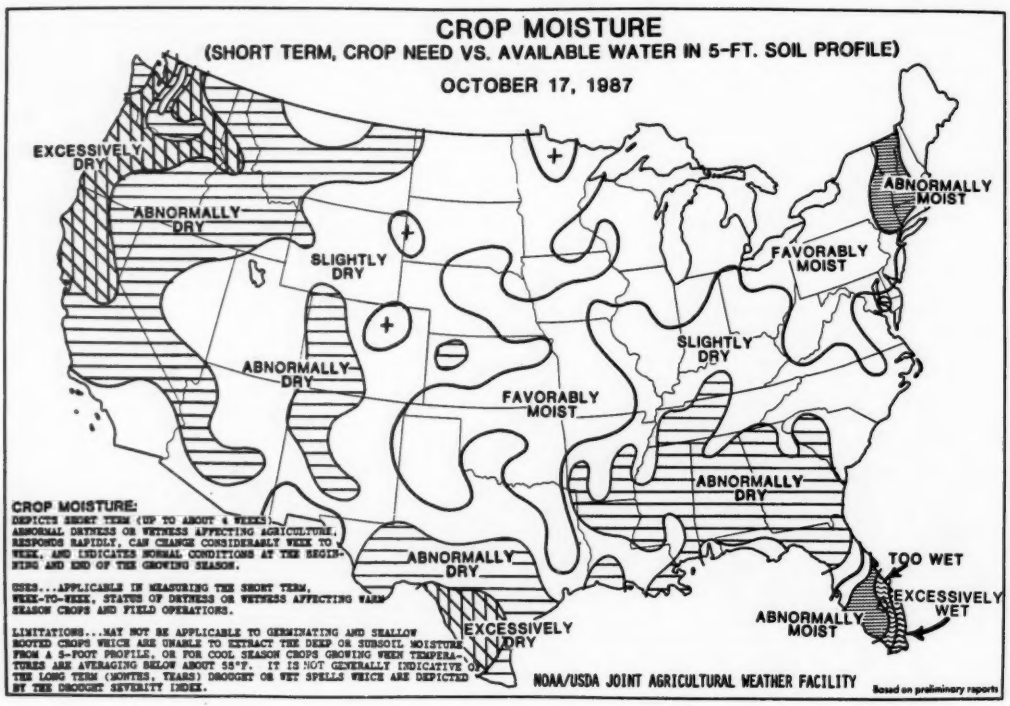




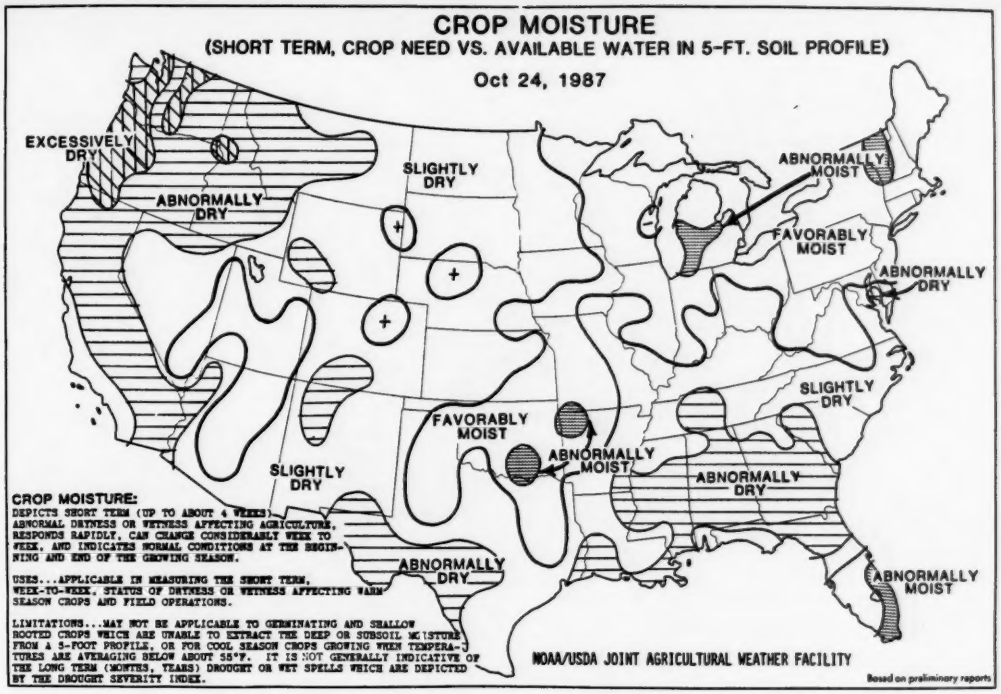


(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)


CROP MOISTURE
(SHORT TERM, CROP NEED VS. AVAILABLE WATER IN 5-FT. SOIL PROFILE)
Oct 10, 1987
EXCESSIVELY DRY
ABNORMALLY DRY
SLIGHTLY DRY
ABNORMALLY MOIST
TOO WET
SLIGHTLY DRY
EXCESSIVELY DRY
FAVORABLY MOIST
ABNORMALLY DRY
EXCESSIVELY DRY
ABNORMALLY MOIST
EXCESSIVELY DRY
CROP MOISTURE:
DEPICTS SHORT TERM (UP TO ABOUT 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE. RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK, AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.
USES...APPLICABLE IN MEASURING THE SHORT TERM, WEEK-TO-WEEK, STATUS OF DRYNESS OR WETNESS AFFECTING WARM SEASON CROPS AND FIELD OPERATIONS.
LIMITATIONS...MAY NOT BE APPLICABLE TO GERMINATING AND SHALLOW ROOTED CROPS WHICH ARE UNABLE TO EXTRACT THE DEEP OR SUBSOIL MOISTURE FROM A 5-FOOT PROFILE, OR FOR COOL SEASON CROPS GROWING WHEN TEMPERATURES ARE AVERAGING BELOW ABOUT 55°F. IT IS NOT GENERALLY INDICATIVE OF THE LONG TERM (MONTHS, YEARS) DROUGHT OR WET SPELLS WHICH ARE DEPICTED BY THE DROUGHT SEVERITY INDEX.
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY
Based on preliminary reports


CROP MOISTURE
(SHORT TERM, CROP NEED VS. AVAILABLE WATER IN 5-FT. SOIL PROFILE)
OCTOBER 17, 1987
EXCESSIVELY DRY
ABNORMALLY DRY
SLIGHTLY DRY
ABNORMALLY MOIST
FAVORABLY MOIST
SLIGHTLY DRY
ABNORMALLY DRY
FAVORABLY MOIST
ABNORMALLY DRY
ABNORMALLY DRY
TOO WET
EXCESSIVELY WET
ABNORMALLY MOIST
EXCESSIVELY DRY
CROP MOISTURE:
DEPICTS SHORT TERM (UP TO ABOUT 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE. RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK, AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.
USES...APPLICABLE IN MEASURING THE SHORT TERM, WEEK-TO-WEEK, STATUS OF DRYNESS OR WETNESS AFFECTING WARM SEASON CROPS AND FIELD OPERATIONS.
LIMITATIONS...MAY NOT BE APPLICABLE TO GERMINATING AND SHALLOW ROOTED CROPS WHICH ARE UNABLE TO EXTRACT THE DEEP OR SUBSOIL MOISTURE FROM A 5-FOOT PROFILE, OR FOR COOL SEASON CROPS GROWING WHEN TEMPERATURES ARE AVERAGING BELOW ABOUT 55°F. IT IS NOT GENERALLY INDICATIVE OF THE LONG TERM (MONTHS, YEARS) DROUGHT OR WET SPELLS WHICH ARE DEPICTED BY THE DROUGHT SEVERITY INDEX.
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY
Based on preliminary reports

(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)


CROP MOISTURE
(SHORT TERM, CROP NEED VS. AVAILABLE WATER IN 5-FT. SOIL PROFILE)
Oct 24, 1987
EXCESSIVELY DRY
ABNORMALLY DRY
SLIGHTLY DRY
ABNORMALLY MOIST
FAVORABLY MOIST
ABNORMALLY DRY
SLIGHTLY DRY
FAVORABLY MOIST
ABNORMALLY MOIST
SLIGHTLY DRY
ABNORMALLY DRY
ABNORMALLY DRY
ABNORMALLY MOIST
CROP MOISTURE:
DEPICTS SHORT TERM (UP TO ABOUT 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE. RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK, AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.
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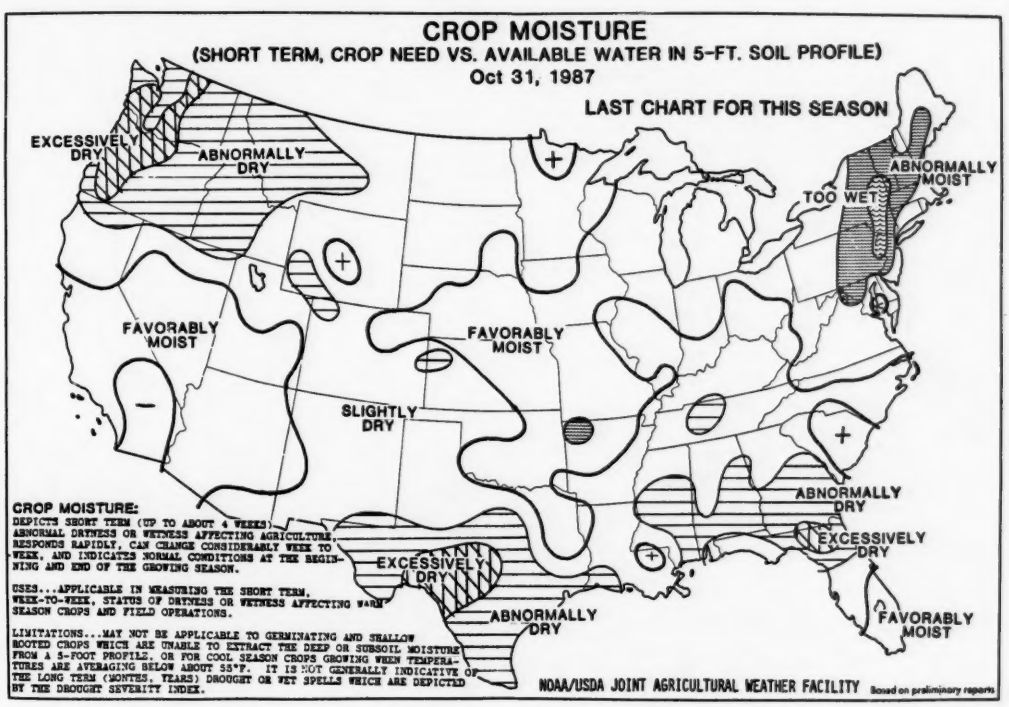
CROP MOISTURE
(SHORT TERM, CROP NEED VS. AVAILABLE WATER IN 5-FT. SOIL PROFILE)
Oct 31, 1987
LAST CHART FOR THIS SEASON
EXCESSIVELY DRY
ABNORMALLY DRY
ABNORMALLY MOIST
TOO WET
FAVORABLY MOIST
FAVORABLY MOIST
SLIGHTLY DRY
ABNORMALLY DRY
EXCESSIVELY DRY
EXCESSIVELY DRY
ABNORMALLY DRY
FAVORABLY MOIST
CROP MOISTURE:
DEPICTS SHORT TERM (UP TO ABOUT 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE. RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK, AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.
USES...APPLICABLE IN MEASURING THE SHORT TERM, WEEK-TO-WEEK, STATUS OF DRYNESS OR WETNESS AFFECTING WARM SEASON CROPS AND FIELD OPERATIONS.
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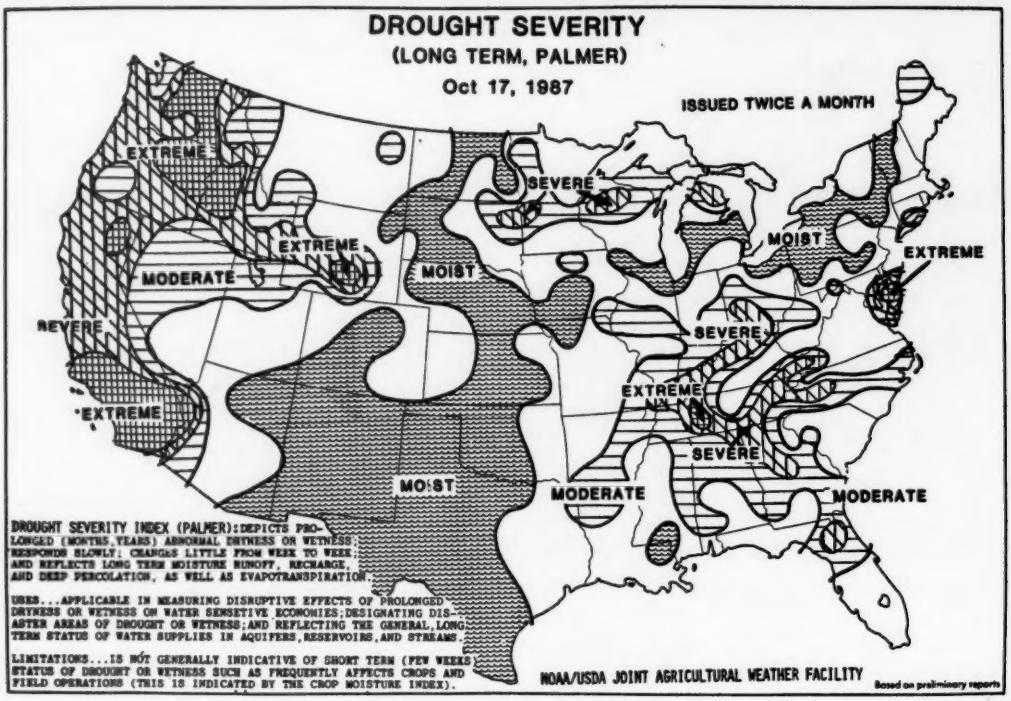
DROUGHT SEVERITY
(LONG TERM, PALMER)
Oct 17, 1987
ISSUED TWICE A MONTH
EXTREME
SEVERE
EXTREME
MODERATE
MOIST
MOIST
EXTREME
SEVERE
SEVERE
EXTREME
EXTREME
SEVERE
MOIST
MODERATE
MODERATE
DROUGHT SEVERITY INDEX (PALMER):DEPICTS PRO-
LONGED (MONTHS,YEARS) ABNORMAL DRYNESS OR WETNESS;
RESPONDS SLOWLY; CHANGES LITTLE FROM WEEK TO WEEK;
AND REFLECTS LONG TERM MOISTURE RUNOFF, RECHARGE,
AND DEEP PERCOLATION, AS WELL AS EVAPOTRANSPIRATION.
USES...APPLICABLE IN MEASURING DISRUPTIVE EFFECTS OF PROLONGED
DRYNESS OR WETNESS ON WATER SENSETIVE ECONOMIES;DESIGNATING DIS-
ASTER AREAS OF DROUGHT OR WETNESS;AND REFLECTING THE GENERAL,LONG
TERM STATUS OF WATER SUPPLIES IN AQUIFERS,RESERVOIRS,AND STREAMS.
LIMITATIONS...IS NOT GENERALLY INDICATIVE OF SHORT TERM (FEW WEEKS)
STATUS OF DROUGHT OR WETNESS SUCH AS FREQUENTLY AFFECTS CROPS AND
FIELD OPERATIONS (THIS IS INDICATED BY THE CROP MOISTURE INDEX).
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY
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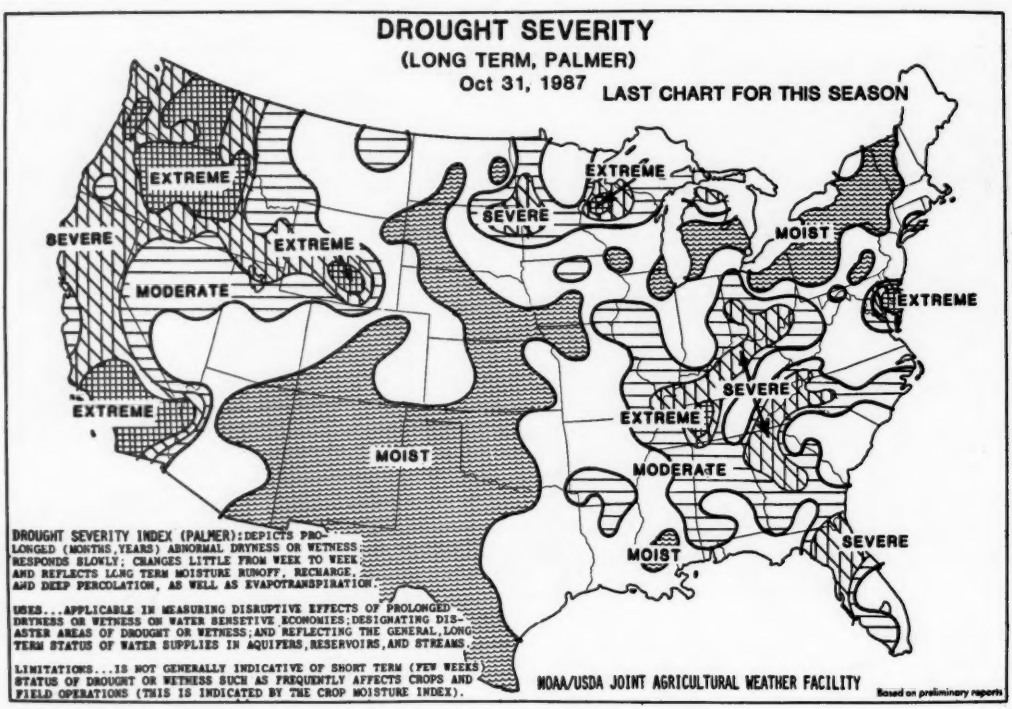
DROUGHT SEVERITY
(LONG TERM, PALMER)
Oct 31, 1987
LAST CHART FOR THIS SEASON
EXTREME
SEVERE
EXTREME
SEVERE
EXTREME
MOIST
MODERATE
EXTREME
SEVERE
EXTREME
MOIST
MODERATE
MOIST
SEVERE
DROUGHT SEVERITY INDEX (PALMER):DEPICTS PRO-
LONGED (MONTHS,YEARS) ABNORMAL DRYNESS OR WETNESS;
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DRYNESS OR WETNESS ON WATER SENSETIVE ECONOMIES;DESIGNATING DIS-
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DROUGHT STRESSES WINTER GRAINS, PASTURES IN PACIFIC NORTHWEST

A drought which began in the Columbia River basin in 1986 (see Weekly Weather and Crop Bulletin, June 10, 1986, Vol. 73, No. 23, p. 4) worsened considerably in 1987 (see Weekly Weather and Crop Bulletin, Oct. 20, 1987, Vol. 74, No. 42, p. 4). Summers are normally dry in the Pacific Northwest, but autumn rains usually begin by late September. In 1987, however, the dry weather typical of midsummer has persisted into late October. Figure 1 shows traces of observed and normal cumulative precipitation which are representative, in this situation, of coastal Oregon and Washington. Yakima, Washington as of October 26, 1987, had gone for 100 days without measurable precipitation, the longest dry period since recordkeeping began in 1909. Figure 2 shows percentage of normal precipitation for July 1–October 22 for selected stations. Lack of moisture has delayed planting of winter grains and has stressed those already planted throughout the important production regions of eastern Washington, Oregon, and Idaho. Conditions of pastures and livestock have deteriorated. The dryness has also increased the risk of forest fires.

Figure 2

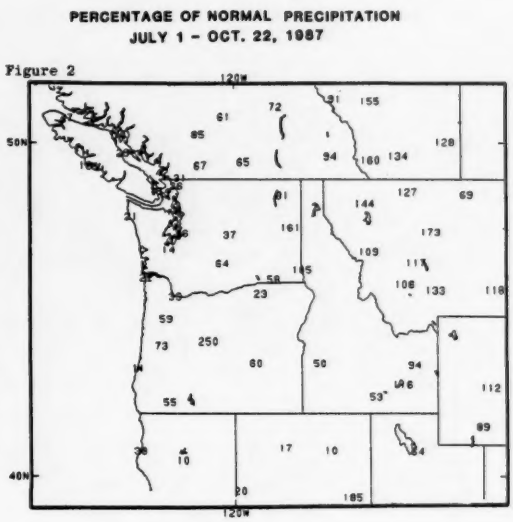
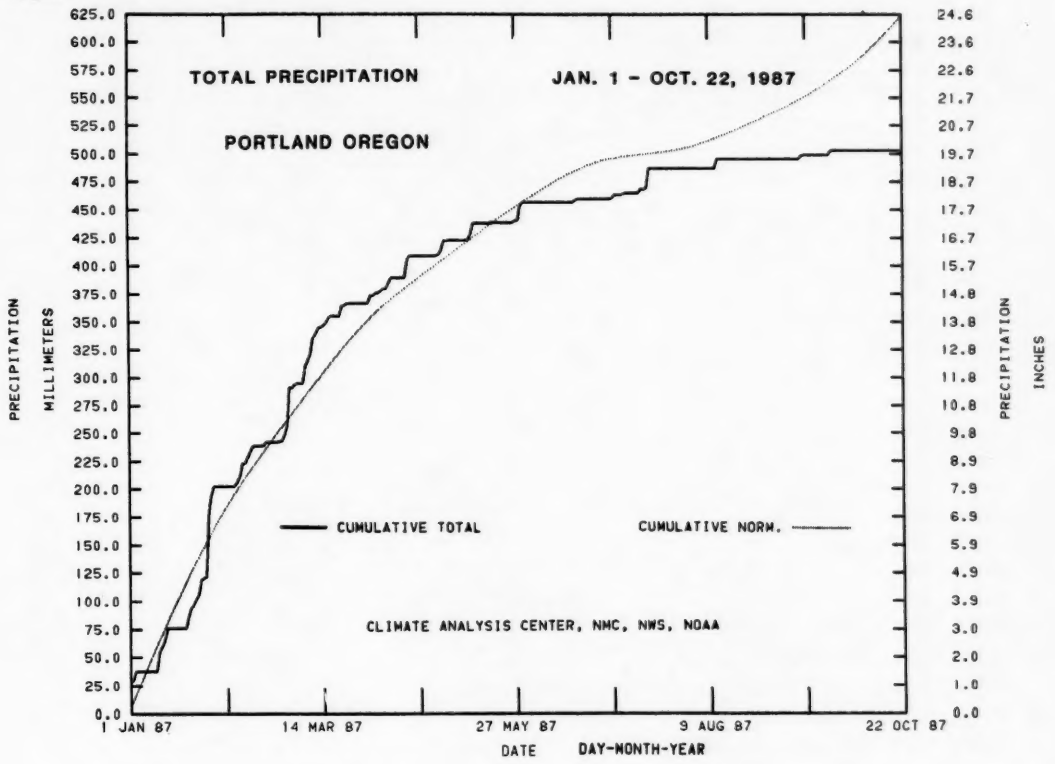


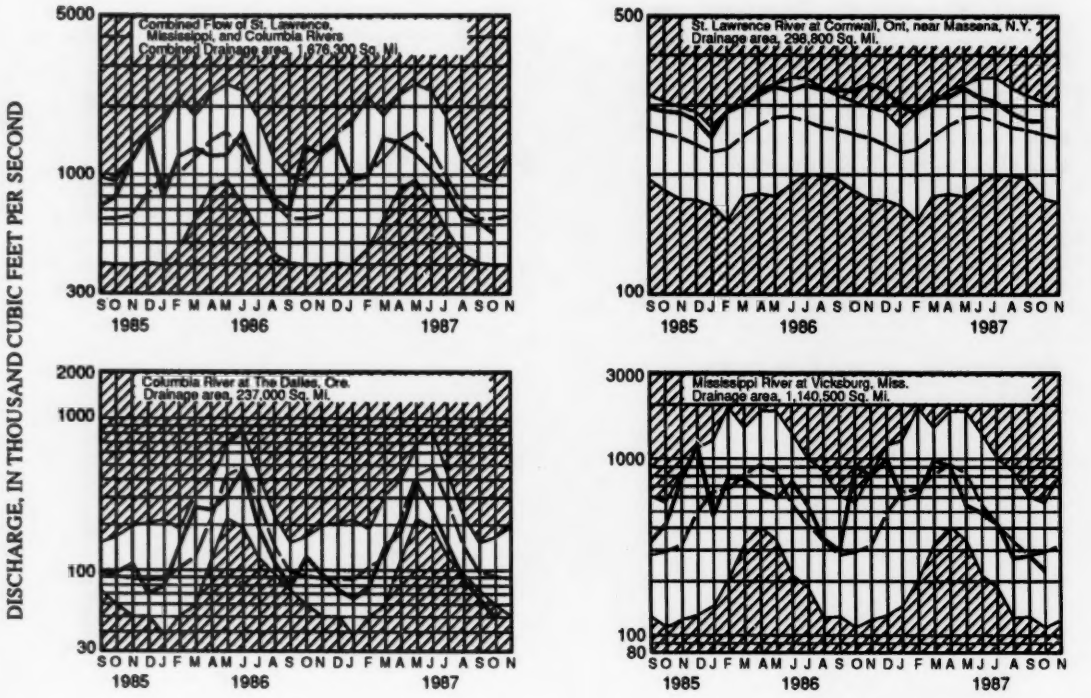
Figure 1



(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR OCTOBER 1987, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	October data of following calendar years	Stream discharge during month: Mean (cfs)	Dissolved-solids concentration[a]: Minimum (mg/L)	Dissolved-solids concentration[a]: Minimum (mg/L)	Dissolved-solids discharge[a]: Mean (tons per day)	Dissolved-solids discharge[a]: Minimum (tons per day)	Dissolved-solids discharge[a]: Minimum (tons per day)	Water temperature[b]: Mean in °C	Water temperature[b]: Minimum, in °C	Water temperature[b]: Minimum, in °C
01463500	Delaware River at Trenton, N.J. (Morrisville, Pa.)	1987	9,224	78	118	2,493	1,503	4,942	13.0	9.0	18.0
		1944-86	6,589	58	156	---	463	8,300	---	8.5	25.5
		(Extreme yr)		(1945)	(1953)		(1963)	(1955)			
			[c]4,918								
07289000	Mississippi River at Vicksburg, Miss.	1987	229,900	295	337	193,400	162,000	249,900	18.0	15.0	24.0
		1975-86	407,900	183	337	256,600	117,000	639,700	20.0	15.0	26.0
		(Extreme yr)		(1979, 1982)	(1983)		(1976)	(1986)			
			[c]295,000								
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (streamflow station at Metropolis, Ill.)	1987	68,700	209	238	---	37,800	56,100	---	19.5	24.0
		1954-86	117,300	135	330	---	11,900	262,000	---	12.0	26.0
		(Extreme yr)		(d)	(1967)		(1985)	(1976)			
			[c]96,680								
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1987	53,100	443	500	69,400	65,200	72,700	14.0	12.0	17.0
		1975-86	90,430	168	558	90,170	51,800	272,000	16.0	10.0	22.5
		(Extreme yr)		(1986)	(1980)		(1976)	(1986)			
			[c]60,140								
14128910	Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1987	122,000	100	112	34,900	23,100	49,200	17.0	15.0	19.0
		1975-86	117,800	73	117	31,400	13,200	48,900	15.5	11.0	19.5
		(Extreme yr)		(1981)	(1977)		(1981)	(1973)			
			[c]91,570								

[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.
[d]Occurred several years.

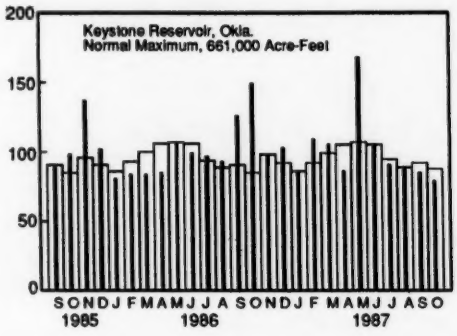
Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING OCTOBER 1987

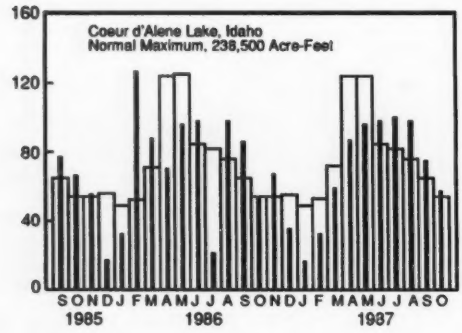
Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	October 1987					
				Monthly mean discharge (cubic feet per second)	Percent of median monthly discharge, 1951—80	Change in discharge from previous month (percent)	Discharge near end of month		
							Cubic feet per second	Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,690	9,647	5,755	120	+66	11,700	7,560	31
01318500	Hudson River at Hadley, N.Y.	1,664	2,909	3,010	214	−16	5,820	3,761	31
01357500	Mohawk River at Cohoes, N.Y.	3,456	5,734	6,610	256	+38	7,000	4,500	31
01463500	Delaware River at Trenton, N.J.	6,780	11,750	9,224	188	−57	17,600	11,380	31
01570500	Susquehanna River at Harrisburg, Pa.	24,100	34,530	15,785	148	−40	11,000	7,100	26
01646500	Potomac River near Washington, D.C.	11,560	[1]11,490	[1]3,290	116	−58	3,400	2,200	31
02105500	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,005	890	45	−36	.....	.....	...
02131000	Pee Dee River at Peedee, S.C.	8,830	9,851	3,510	76	−62	5,130	3,315	31
02226000	Altamaha River at Doctortown, Ga.	13,600	13,880	1,883	36	−38	1,810	1,169	28
02320500	Suwannee River at Branford, Fl.	7,880	6,987	3,440	75	−29	3,120	2,016	31
02358000	Apalachicola River at Chattahoochee, Fl.	17,200	22,570	7,960	73	−24	7,960	5,144	31
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	23,300	795	20	−71	660	426	30
02489500	Pearl River near Bogalusa, La.	6,630	9,768	2,305	109	−20	2,280	1,473	31
03049500	Allegheny River at Natrona, Pa.	11,410	[1]19,480	[1]14,250	203	−38	8,460	5,467	26
03085000	Monongahela River at Braddock, Pa.	7,337	[1]12,510	[1]4,398	114	−41	2,100	1,360	26
03193000	Kanawha River at Kanawha Falls, W.Va.	8,367	12,590	2,831	47	−24	2,070	1,337	26
03234500	Scioto River at Higby, Ohio.	5,131	4,547	781	103	+40	867	560	30
03294500	Ohio River at Louisville, Ky.[2]	91,170	11,600	40,700	114	−27	27,920	18,045	29
03377500	Wabash River at Mount Carmel, Ill.	28,635	27,220	4,587	66	−7	4,500	2,910	28
03469000	French Broad River below Douglas Dam, Tenn.	4,543	6,798	897	24	−72	.....	.....	...
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,163	1,970	88	−3	2,548	1,646	31
04264331	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	298,800	242,700	273,000	108	0	254,000	164,200	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	25,150	16,800	88	+65	22,900	14,800	30
05082500	Red River of the North at Grand Forks, N.Dak.	30,100	2,551	660	49	−37	571	369	26
05133500	Rainy River at Manitou Rapids, Minn.	19,400	11,830	9,300	86	−17	8,100	5,240	26
05330000	Minnesota River near Jordan, Minn.	16,200	3,402	570	54	−26	580	374	31
05331000	Mississippi River at St. Paul, Minn.	36,800	[1]10,610	4,737	73	+11	4,700	3,040	31
05365500	Chippewa River at Chippewa Falls, Wis.	5,600	5,100	2,264	82	+51	2,475	1,599	31
05407000	Wisconsin River at Muscoda, Wis.	10,300	8,617	4,067	75	−4	4,788	3,094	31
05446500	Rock River near Joslin, Ill.	9,551	5,873	4,790	146	−41	454	293	31
05474500	Mississippi River at Keokuk, Iowa.	119,000	62,620	32,930	93	−31	36,900	23,850	31
06214500	Yellowstone River at Billings, Mont.	11,796	7,038	2,681	64	−17	2,680	1,732	30
06934500	Missouri River at Hermann, Mo.	524,200	79,490	53,130	88	−27	48,300	31,220	31
07289000	Mississippi River at Vicksburg, Miss.[4]	1,140,500	576,600	229,900	78	−17	193,000	124,700	26
07331000	Washita River near Dickson, Okla.	7,202	1,368	1,102	212	−40	949	613	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, N.Mex.	9,730	725	299	108	+6	331	213	31
09315000	Green River at Green River, Utah.	44,850	6,298	2,993	104	+12	3,580	2,310	27
11425500	Sacramento River at Verona, Calif.	21,257	18,820	7,426	70	−23	6,422	4,150	28
13269000	Snake River at Weiser, Idaho.	69,200	18,050	12,500	86	+24	13,000	8,400	31
13317000	Salmon River at White Bird, Idaho.	13,550	11,250	2,880	58	+15	3,160	2,042	31
13342500	Clearwater River at Spalding, Idaho.	9,570	15,480	1,780	47	+89	3,060	1,977	31
14105700	Columbia River at The Dalles, Oreg.[5]	237,000	[1]193,100	[1]48,500	53	−26	122,900	79,430	28
14191000	Willamette River at Salem, Oreg.	7,280	[1]23,510	[1]2,490	37	−14	7,260	4,692	28
15515500	Tanana River at Nenana, Alaska.	25,600	23,460	18,260	118	−40	15,000	9,700	31
08MF005	Fraser River at Hope, British Columbia.	83,800	96,290	36,720	50	−38	27,900	18,030	30

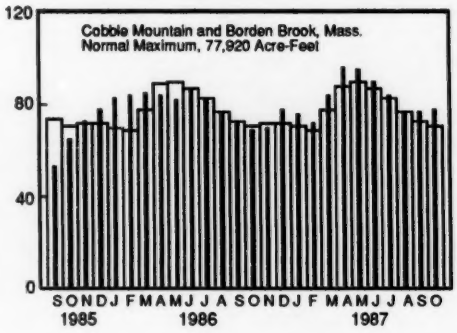
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

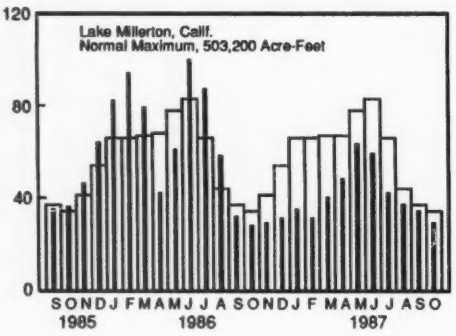
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

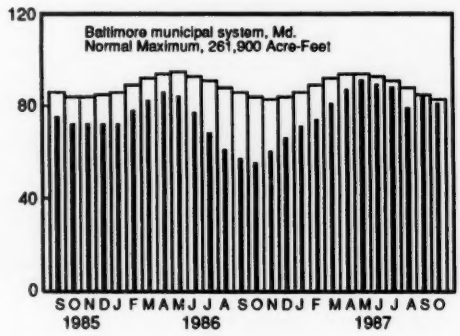


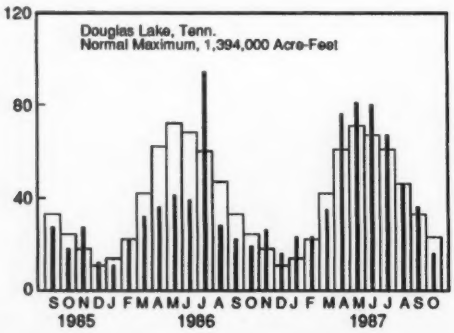
PERCENT OF NORMAL MAXIMUM

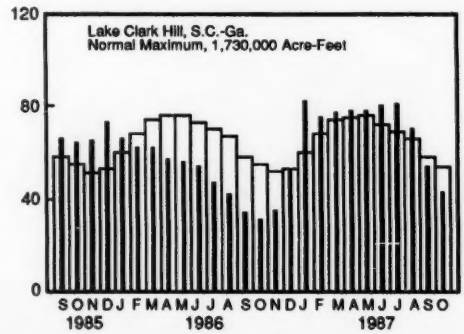












USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1987

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of Oct. 1987	End of Oct. 1986	Average for end of Oct.	End of Sept. 1987	
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs(P)	34	41	35	33	[b]226,300
QUEBEC					
Allard (P)	42	79	59	61	280,600
Gouin (P)	49	93	68	52	6,954,000
MAINE					
Seven reservoir systems (MP)	51	57	52	53	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	73	73	73	76	76,450
Lake Francis (FPR)	78	82	76	75	99,310
Lake Winnipesaukee (PR)	75	72	57	74	165,700
VERMONT					
Harriman (P)	77	69	61	82	116,200
Somerset (P)	90	78	69	87	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	78	69	71	77	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	97	74	54	96	786,700
Indian Lake (FMP)	43	73	56	44	103,300
New York City reservoir system (MW)	84	74	65	80	1,680,000
NEW JERSEY					
Wanaque (M)	76	60	64	78	85,100
PENNSYLVANIA					
Allegheny (FPR)	44	38	34	48	1,180,000
Pymatuning (FMR)	97	85	79	96	188,000
Raystown Lake (FR)	67	65	56	67	761,900
Lake Wallenpaupack (PR)	43	55	49	64	157,800
MARYLAND					
Baltimore municipal system (M)	81	55	83	84	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	91	92	82	92	288,800
Narrows (Badin Lake) (P)	85	84	94	92	128,900
High Rock Lake (P)	72	58	58	77	234,800
SOUTH CAROLINA					
Lake Murray (P)	77	83	64	82	1,614,000
Lakes Marion and Moultrie (P)	73	83	67	81	1,862,000
SOUTH CAROLINA—GEORGIA					
Clark Hill (FP)	43	31	54	54	1,730,000
GEORGIA					
Burton (PR)	95	96	68	96	104,000
Sinclair (MPR)	87	87	77	88	214,000
Lake Sidney Lanier (FMPR)	41	35	51	46	1,686,000
ALABAMA					
Lake Martin (P)	81	78	68	87	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	28	29	32	36	2,293,000
Douglas Lake (FPR)	16	19	23	36	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	55	52	49	64	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	40	45	40	48	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	46	38	47	57	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	82	91	78	75	365,000
Wisconsin River (21 reservoirs) (PR)	49	92	66	46	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	37	36	29	43	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	83	93	89	84	22,700,000
SOUTH DAKOTA					
Angostura (I)	67	90	72	67	130,768
Belle Fourche (I)	57	51	36	53	185,200
Lake Francis Case (FIP)	61	65	58	72	4,589,000
Lake Oahe (FIP)	82	87	. . .	85	22,240,000
Lake Sharpe (FIP)	100	99	96	99	1,697,000
Lewis and Clark Lake (FIP)	90	94	95	91	432,000
NEBRASKA					
Lake McConaughy (IP)	75	78	68	76	1,948,000
OKLAHOMA					
Eufaula (FRP)	93	124	88	95	2,378,000
Keystone (FPR)	79	149	88	85	661,000
Tenkiller Ferry (FPR)	100	139	92	102	628,200
Lake Altus (FIMR)	84	100	47	85	133,000
Lake O'The Cherokees (FPR)	85	111	83	86	1,492,000
OKLAHOMA—TEXAS					
Lake Texoma (FMPRW)	89	108	93	92	2,722,000
TEXAS					
Bridgeport (IMW)	85	92	48	90	386,400
Canyon (FMR)	83	104	77	89	385,600
International Amistad (FIMPW)	98	81	84	97	3,497,000
International Falcon (FIMPW)	102	47	74	101	2,668,000
Livingston (IMW)	95	101	85	96	1,788,000
Possum Kingdom (IMPRW)	65	97	99	66	570,200
Red Bluff (FI)	70	63	27	72	307,000
Toledo Bend (P)	75	85	79	76	4,472,000
Twin Buttes (FIM)	77	41	29	77	177,800
Lake Kemp (IMW)	88	124	86	94	268,000
Lake Meredith (FWM)	37	27	38	38	796,900
Lake Travis (FIMPRW)	84	105	80	93	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	77	89	88	76	2,043,000
Fort Peck (FPR)	83	85	86	83	18,910,000
Hungry Horse (FIPR)	67	80	88	78	3,451,000
WASHINGTON					
Ross (PR)	79	89	86	89	1,052,000
Franklin D. Roosevelt Lake (IP)	93	99	102	99	5,022,000
Lake Chelan (PR)	74	83	74	92	676,100
Lake Cushman (PR)	70	55	84	85	359,500
Lake Merwin (P)	100	104	87	101	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	20	54	48	25	1,235,000
Coeur d'Alene Lake (P)	57	53	54	75	238,500
Pend Oreille Lake (FP)	28	48	69	86	1,561,000
IDAHO—WYOMING					
Upper Snake River (8 reservoirs) (MP)	23	57	51	23	4,401,000
WYOMING					
Boysen (FIP)	88	90	83	93	802,000
Buffalo Bill (IP)	43	63	74	50	421,300
Keyhole (F)	40	34	42	41	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	43	66	47	55	3,056,000
COLORADO					
John Martin (FIR)	68	62	14	72	364,400
Taylor Park (IR)	73	72	55	78	106,200
Colorado–Big Thompson project (I)	69	82	56	36	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	89	92	. . .	100	31,620,000
UTAH—IDAHO					
Bear Lake (IPR)	69	84	60	70	1,421,000
CALIFORNIA					
Folsom (FIP)	32	57	55	44	1,000,000
Hetch Hetchy (MP)	57	67	50	65	360,400
Isabella (FIR)	25	48	27	27	568,100
Pine Flat (FI)	14	53	40	12	1,001,000
Clair Engle Lake (Lewiston) (P)	66	75	70	75	2,438,000
Lake Almanor (P)	87	75	52	93	1,036,000
Lake Berryessa (FIMW)	62	85	75	71	1,600,000
Millerton Lake (FI)	29	28	34	34	503,200
Shasta Lake (FIPR)	50	72	64	48	4,377,000
CALIFORNIA—NEVADA					
Lake Tahoe (IPR)	37	75	49	42	744,600
NEVADA					
Rye Patch (I)	31	66	58	36	194,300
ARIZONA—NEVADA					
Lake Mead and Lake Mohave (FIMP)	92	92	72	92	27,970,000
ARIZONA					
San Carlos (IP)	53	66	20	53	935,100
Salt and Verde River system (IMPR)	60	79	39	78	2,019,100
NEW MEXICO					
Conchas (FIR)	92	87	79	96	330,100
Elephant Butte and Caballo (FIPR)	89	94	32	90	2,442,000

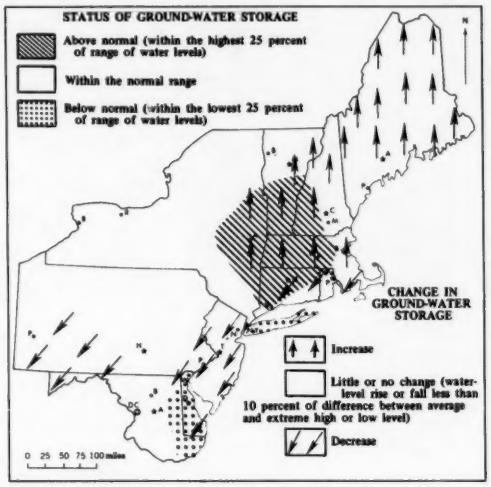
[a] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

GROUND-WATER CONDITIONS DURING OCTOBER 1987

Ground-water levels continued to rise seasonally in much of northern and central New England, but declined in Rhode Island, eastern Connecticut, and southeastern Massachusetts. (See map.) Levels fell also in much of New Jersey, Delaware, western Maryland, and southwestern Pennsylvania. Above-average levels persisted in much of central New England and adjacent New York State. Ground-water levels were below average for the end of October in Delaware and on Long Island, New York.

In the Southeastern States, ground-water levels declined in Kentucky, Virginia, North Carolina, and Florida. Levels declined also in most wells in West Virginia and Mississippi. Changes in level were mixed in Arkansas, Louisiana, and Georgia. Water levels were above long-term averages in Kentucky and below average in Arkansas and Louisiana. Levels were mixed with respect to average in West Virginia, Virginia, and North Carolina. A new low level for October occurred in the key well at Memphis in western Tennessee, despite a slight net rise during the month. The level in the key well at Montgomery, Alabama, also was at a new October low, again despite a slight rise during the month. A new record low for October occurred in a key well in Chatham County, Georgia, and new October lows occurred in a number of wells in coastal and northeastern Mississippi.

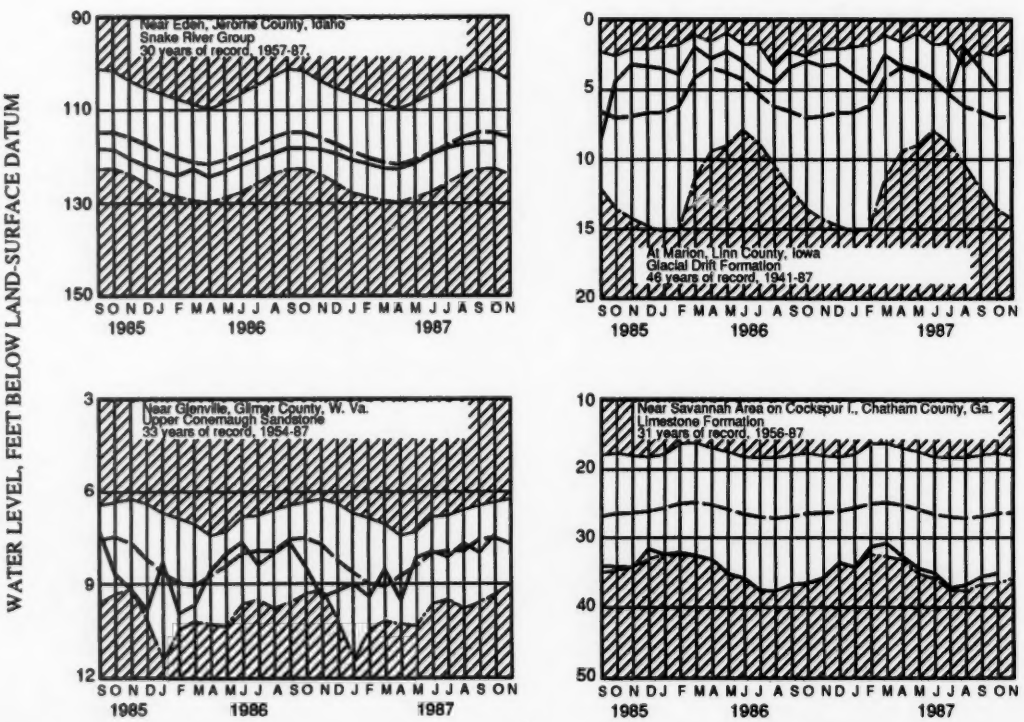
In the central and western Great Lakes States, ground-water levels rose in Michigan, showed mixed changes in level in Minnesota, and declined in Wisconsin, Indiana, and Iowa.


STATUS OF GROUND-WATER STORAGE
Above normal (within the highest 25 percent of range of water levels)
Within the normal range
Below normal (within the lowest 25 percent of range of water levels)
CHANGE IN GROUND-WATER STORAGE
Increase
Little or no change (water-level rise or fall less than 10 percent of difference between average and extreme high or low level)
Decrease
0 25 50 75 100 miles

Map showing ground-water storage near end of October and change in ground-water storage from end of September to end of October.

MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.

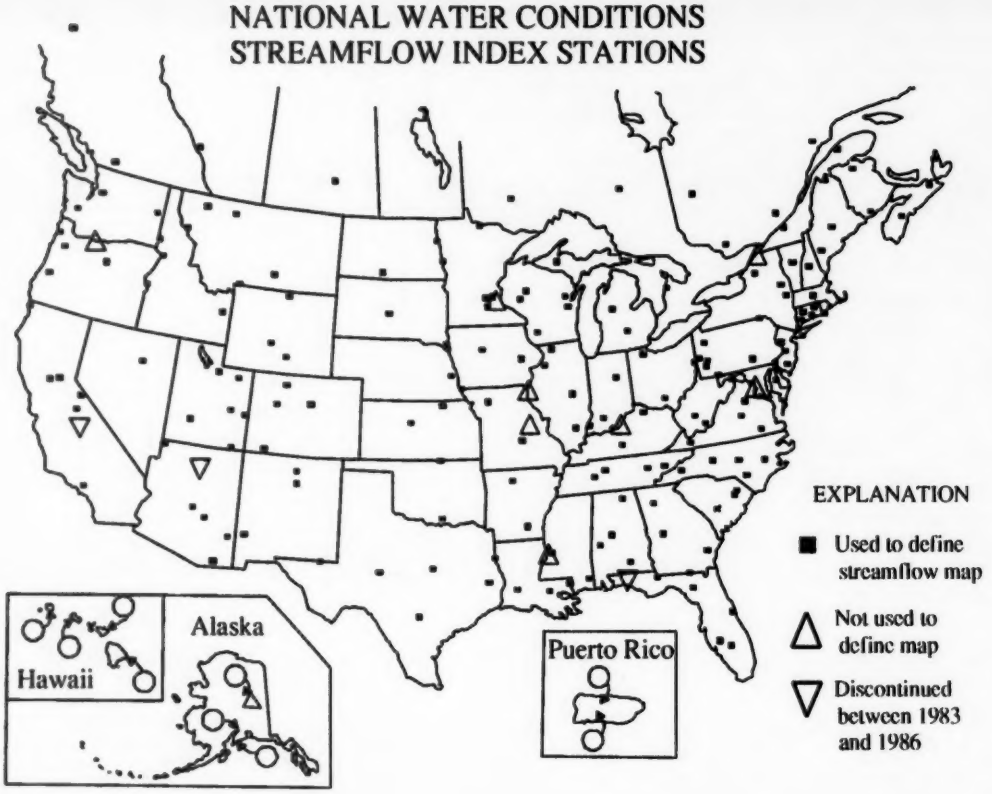


Levels were near average and in the normal range in Wisconsin and Indiana, below the normal range in Ohio, and mixed with respect to average in Minnesota and Iowa. In the Western States, ground-water levels rose in Washington and New Mexico, and declined in North Dakota and southern California. Mixed water-level changes occurred in Idaho, Nebraska, Nevada, Utah, Kansas, Arizona, and Texas. Levels were above long-term averages in Nebraska, and below average in southern California and Arizona. Levels were mixed with respect to average in Washington, Idaho, North Dakota, Nevada, Utah, Kansas, New Mexico, and Texas. New October high ground-water levels occurred in the Steptoe Valley well in Nevada and, despite a net decline of more than a foot during the month, in the Blanding well in Utah. New October low levels occurred in the Las Vegas Valley well in Nevada, in the Holladay well in Utah, in the Kansas Agricultural Experiment Station well in Colby, Kansas, and in the Dayton observation well in New Mexico. All of these new lows occurred despite net rises in levels during the month.

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES—OCTOBER 1987

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since:		Year records began	Remarks
			Last month	Last year		
Glacial drift at Hanska, south-central Minnesota.	−10.30	−1.82	−1.63	−5.49	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	−5.36	−0.41	+0.07	−1.94	1935	
Glacial drift at Marion, Iowa.....	−4.88	+1.82	−1.44	−1.93	1941	
Glacial drift at Princeton in northwestern Illinois.	−7.70	+6.81	−1.22	+0.20	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	−17.26	−0.93	−0.58	−0.75	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	−19.25	+5.82	−0.66	−1.15	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	−106.98	−16.98	+0.12	−0.82	1941	Oct. low.
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	−19.41	+1.35	−1.54	+0.54	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas.	−234.50	−27.91	−0.20	−13.10	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	−29.3	−6.2	+0.4	−2.2	1952	Oct. low.
Limestone aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	−35.10	−7.64	+0.51	+1.46	1956	
Sand and gravel in Puget Trough, Tacoma, Washington.	−104.93	+1.10	+1.01	−1.81	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	−464.4	−4.9	−0.8	−2.0	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	−116.9	−1.8	−0.1	+1.2	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	−18.13	+13.69	+3.09	−10.65	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	−4.15	+2.22	−1.03	−1.55	1935	
Alluvial valley fill in Steptoe Valley, Nevada....	−7.86	+5.17	+0.52	+0.18	1950	Oct. high.
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	−19.66	+0.85	−0.44	−4.09	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria, California	−126.69	−14.43	−1.16	−7.69	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	−103.3	−21.9	+0.2	+0.7	1951	
Hueco bolson, El Paso area, Texas.....	−266.83	−18.16	+1.19	−0.89	1965	
Evangeline aquifer, Houston area, Texas.....	−311.50	− 5.19	−0.58	+6.72	1965	



The map shows the locations of the 191 index stations that currently report data for the National Water Conditions and also the locations of three stations that were index stations, but have been discontinued in recent years. Those stations not used to define the streamflow map are on rivers with large drainage areas: St. Lawrence River at Cornwall, Ontario; Potomac River near Washington, D. C.; Mississippi River at St. Paul, Minnesota; Mississippi River at Keokuk, Iowa; Missouri River at Herman, Missouri; Ohio River at Louisville, Kentucky; Mississippi River at Vicksburg, Mississippi; Columbia River at The Dalles, Oregon; and Tanana River at Nanana, Alaska.

Contents of 76 percent of reporting reservoirs were near or above average for the end of October, compared with 78 percent for the end of September. Most reporting reservoirs in Vermont, Massachusetts, New York, New Jersey, Pennsylvania, the Carolinas, Georgia, Alabama, Nebraska, Texas, Arizona, New Mexico, and Colorado had contents that were more than 5 percent of normal maximum contents above the average for the end of October. In contrast, most reporting reservoirs in Quebec, Montana, Idaho, Washington, and California had contents that were more than 5 percent of normal maximum contents below the average for the end of October. The following reservoirs or reservoir systems had both a decline of more than 5 percent of normal maximum contents during the month and monthend contents more than 5 percent of normal maximum contents below monthend averages: Allard (Quebec); Lake Wallenpaupack (Pennsylvania); Narrows (North Carolina); Clark Hill (South Carolina-Georgia); Douglas Lake (Tennessee Valley); Keystone (Oklahoma); Hungry Horse (Montana); Pend Oreille Lake (Idaho); Buffalo Bill (Wyoming); Ross, Franklin D. Roosevelt Lake, and Lake Cushman (Washington); and Folsom Lake and Lake Berrysea (California). In contrast, only two reservoir systems, Chippewa and Flambeau (Wisconsin) and Colorado-Big Thompson (Colorado), had both an increase of more than 5 percent of normal maximum contents during the month and monthend contents that were more than 5 percent of normal maximum contents above monthend averages. Graphs of contents for seven reservoirs are shown on page 14 with contents for the 100 reporting reservoirs given on page 15.

TEMPERATURE OUTLOOK FOR NOVEMBER 1987 THROUGH JANUARY 1988

PRECIPITATION OUTLOOK FOR NOVEMBER 1987 THROUGH JANUARY 1988

NATIONAL WATER CONDITIONS

OCTOBER 1987

Based on reports from the Canadian and U.S. Field offices; completed November 24, 1987

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EXPLANATION OF DATA (Revised April 1987)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations—18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951–80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The *persistence/change* map shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. The table below the map shows areal streamflow range conditions for all index stations reporting data for this month and compares total flow of the stations reporting data for both last month and this month.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range) 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as; *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence;* a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground-water levels,* unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for October are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissloved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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